Technical Report

The three-in-one assistive technologies for seniors—support, move, table

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Abstract: We offer the "supportive = assistive" technologies senior citizens need in order to improve the safety of medical visiting, the quality of medical caring, and the satisfaction with environmental security. The Three-in-One Assistive Technologies for Seniors are designed in accordance with the present circumstance to not only be available as clinic equipment and facilities, but also extensive for the continual use of wards or households. In this regard, the goal of this innovative design is to make them—medical apparatus, personal movement assistive technologies, daily living assistive technologies—equivalent.

Keywords: Assistive technologies; innovative design; senior care; moving safety

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Motivation for invention

The rate of Taiwanese old age population (aged over 65) reached 7 percent in 1993 and went up to 12.51 percent at the end of 2015 (Department of Statistics, Ministry of the Interior, 2016). To meet the needs of the aging population, safety measures should be properly added to medical equipment and environment, establishing a friendlier and safer medical environment for senior citizens. This initiates the motivation for innovative invention.

Original case procedure

Support the physical activity of geriatric patients is relatively slow, unstable and weak, so the medical personnel must ensure their safety to protect them from falling down. The status quo is as follows: body weight scales without grab rails put patients in an unsteady state on and off the scale (*Figure 1*); the chair grab rails fail to offer

Figure 1 Usage of body weight.

complete assistance in patients' standing up (*Figure 2*); and examination beds without grab rails around concern the medical personnel about geriatric patients' losing balance and falling down.

Innovation or design improvement procedure

Goal setting

We offer the "supportive = assistive" technologies senior citizens need in order to improve the safety of medical visiting, the quality of medical caring, and the satisfaction with environmental security. The Three-in-One Assistive Technologies for Seniors are designed in accordance with the present circumstance to not only be available as clinic equipment and facilities, but also extensive for the continual use of wards or households (*Figure 3*). In this regard, the goal of this innovative design is to make them—medical apparatus, personal movement assistive technologies, daily living assistive technologies—equivalent.

Figure 2 Standing up from chairs.

Professional applicability and promotional value

From the aspect of patients and their family

(I) improve trust in the safety of clinic environment;
(II) strengthen the security of clinic equipment protection;
(III) boost satisfaction with well-thought-out service.

From the aspect of medical personnel

(I) improve caring safety;
(II) increase work satisfaction.

Promotional value and practicability

Practicability

The assistive technologies can be applied to body weight scales, chairs, toilets, and beds; the grab rails and mobility aids can also double as dining tables and bedside tables, further increasing their practical value.

Necessity and promotion

In the aging society, it is necessary and required to have safety grab rails anytime and anywhere. This innovative

Figure 3 New-project products.

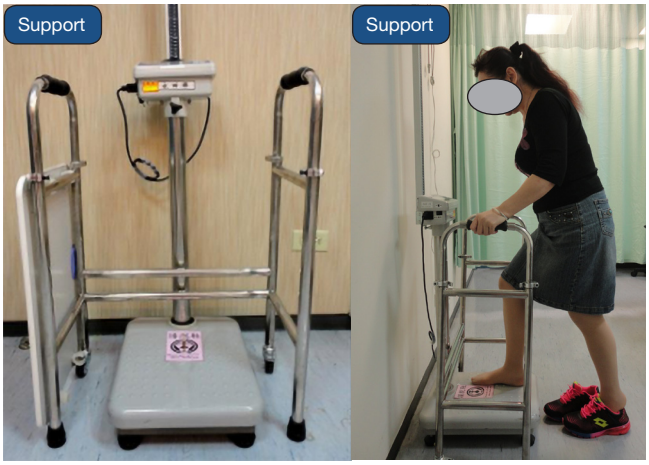

Figure 4 Body weight scale grab rails.

Figure 5 Table and chair grab.

invention has been widely applied to the assistive grab rail of clinic equipment, further applicable to wards and households. The high demand for it makes it worthwhile for promotion to benefit more users.

New project usage

Support: "Body Weight Scale Grab Rails", "Table and Chair Grab Rails" (*Figures 4,5*);

"Off-bed Grab Rails", "Toilet Fixed Grab Rails" "Washroom Grab Rails" (*Figures 6-9*);

Move: "Mobility Aids" (*Figure 10*);

Figure 6 Off-bed grab rails.

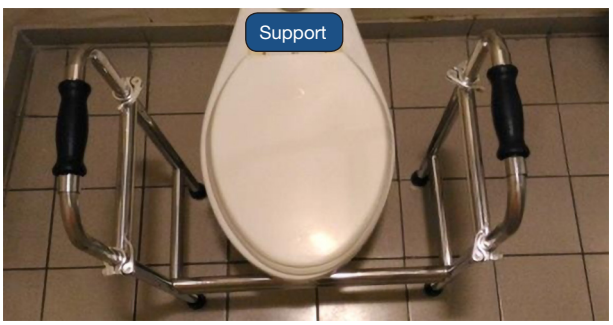

Figure 7 Toilet fixed grab rails.

Table: "Convenience Tables" (*Figure 11*).

Motivation for innovation

Our unit is an out-patient department affiliated to a medical center in northern Taiwan, with elderly patients accounting for 26.3% in total patient population dated from January 2013 to December 2014. According to our patient safety reporting system that traces back to the period between 2010 and 2012, it is found that the falls of elderly patients account for 48.8% of the total cases of falls. It indicates that elderly patients are the most vulnerable group to falls due to factors of aging, diseases, slowness of physical activities

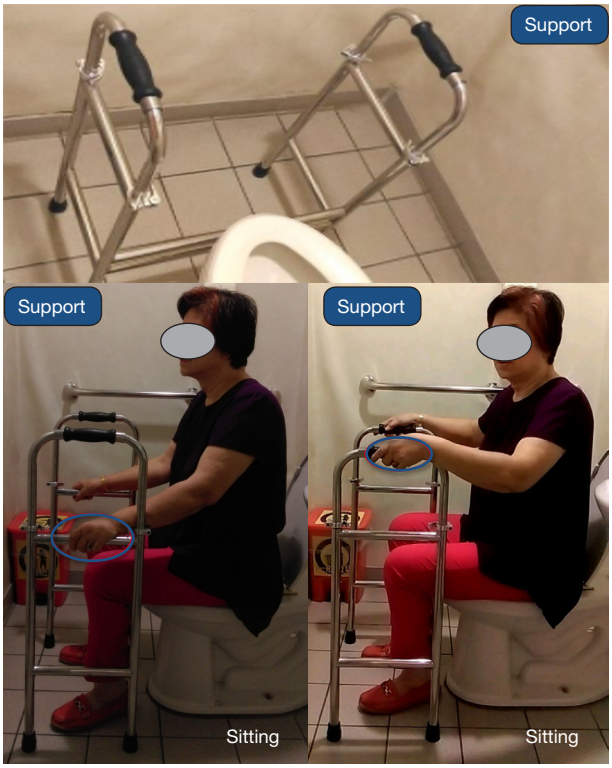

Figure 8 Washroom grab.

Figure 9 Male standing.

Figure 10 Mobility aids.

Figure 11 Convenience tables.

and instability. Besides, during their hospital visits, elderly patients often have to stand on the body weight scale for measurement; when these elderly patients are on and off the scale, it is often more time-consuming and labor-taking for them than younger patients do, even at the risk of frequent falls during the process. Based on this, the motivation for innovation arises, in the hope of offering elderly patients

Figure 12 Outpatient injection room—dining on bed.

Figure 13 Outpatient injection room—convenience tables.

handy supportive devices to reduce the rate of falls and consequent harm, creating a better care environment.

Status Quo prior to Innovation

Due to slow physical activity, instability and frailty, elderly patients need the special care of nursing staff to avoid the occurrence of falls. Before the implementation of innovation, we conducted a sampling survey of the elder patients without the accompaniment of family and without the aid of supportive devices in two internal medicine clinics. From a sample size of 19 elderly patients under observation, we find that:

(I) When the elderly patients were on and off the body weight scale, 100% of them would involuntarily support themselves against the wall or pull the body weight scale to keep themselves stable (*Figure 1*).

(II) After seeing the doctor, 68.42% of the elderly patients would uphold themselves by chair grab rails and table to stand up (*Figure 2*), with 31.58% of them able to stand up on their own.

For those elderly patients on the examination bed, nursing staff were often concerned with their instability when they were trying to get off the bed; in this case, 100% of nursing staff would stand by their side for assistance (*Figure 3*).To consider the above-mentioned factors altogether, the status quo of elderly patients includes: (I) the body weight scale without grab rails leads to patients' instability when they are on and off it; (II) the side grab rails of chairs cannot fully assist patients in moving forward and standing up; (III) and examination beds without grab rails for support concern nursing staff about patients' losing balance and possible falls during their attempts to get off the bed.

Outcomes after innovation

About patients

The number of field interview with internal medicine clinic patients who use "The Three-in-One Assistive Technologies for Seniors—Support, Move, Table" reaches 27 people in total, with 100% of them agreeing that it offers

Table 1 Nursing staff's satisfaction with the clinic equipment in the original project and new project (N=15)

Items	Original project						New project					
	Very satisfied	Satisfied	Average	Unsatisfied	Very unsatisfied	Average satisfaction	Very satisfied	Satisfied	Average	Unsatisfied	Very unsatisfied	Average satisfaction
Clinic safety	0	0	12	8	7	1.8	60	12	0	0	0	4.8
Stability	0	0	15	12	4	2.1	55	16	0	0	0	4.7
Practicability	0	0	12	14	4	2.0	55	16	0	0	0	4.7
Convenience	0	0	15	10	5	2.0	35	32	0	0	0	4.5
Overall satisfaction						2.0						4.7

Figure 14 Outpatient visit—walking assistance.

proper support, ensures clinic visit safety, lowers the risk of falls out of losing balance, and recognizes the practicability of switching to use the dining table (*Figure 12*), convenience table (*Figure 13*) and walking assistance (*Figure 14*). Elderly patients suffer from a worsening sense of balance and reaction due to their weakening bodily functions. "The Three-in-One Assistive Technologies for Seniors—Support, Move, Table" enhances the safety measures of clinic equipment, builds up trust in and satisfaction with clinic safety, thereby creating a friendly, safe clinic environment.

About nursing staff

"The Three-in-One Assistive Technologies for Seniors – Support, Move, Table" both reduces nursing staff's worry about elder patients' risk of falls due to the lack of safety assistance equipment, and increases caring safety and satisfaction. A field survey of 15 nursing staff who use the assistive technologies shows that 100% of them are satisfied with it (*Table 1*), unanimously endorsing the assistive function offered by "The Three-in-One Assistive Technologies for Seniors—Support, Move, Table" in reducing their worry about the occurrence of patients' falls; in addition, all the nursing staff agree that the usage of bathroom grab rails and convenience tables (*Figure 15*) extends its range of applications and even apply at wards (*Figure 16*) which not only meet clinical needs but offer living practicability.

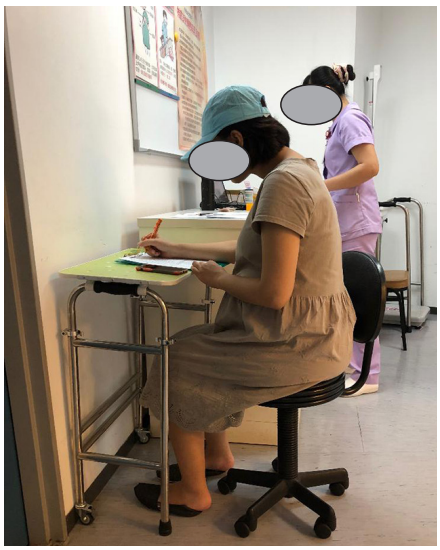

Figure 15 Outpatient visit—writing desks.

Figure 16 Ward—dining tables.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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